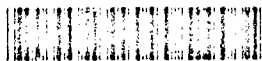


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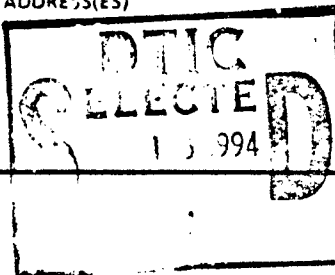


DOCUMENTATION PAGE

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2. REPORT DATE 12/23/75		3. REPORT TYPE AND DATES COVERED	
4. TITLE AND SUBTITLE ANALYSIS OF EXPLORATORY DRILLING DATA, ROCKY MOUNTAIN ARSENAL		5. FUNDING NUMBERS 1	
6. AUTHOR(S) KOLMER, J.			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ROCKY MOUNTAIN ARSENAL (CO.) COMMERCE CITY, CO		8. PERFORMING ORGANIZATION REPORT NUMBER 81266R34	
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12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) AN EXPLORATORY DRILLING PROGRAM WAS INITIATED AT RMA TO GATHER SPECIFIC INFORMATION ON THE SUBSURFACE SYSTEM. 54 BORE HOLES WERE DRILLED ALONG SECTIONS SHOWN ON ENCLOSURE #1. THE LOGS FROM THESE BORE HOLES SHOW THE NATURE OF THE SEDIMENT MAKING UP THE GROUND WATER TABLE AQUIFER, THE DEPTH TO GROUND WATER, AND THE DEPTH TO BEDROCK. SUBSURFACE CROSS-SECTIONS WERE CONSTRUCTED FROM THESE LOGS.			
14. SUBJECT TERMS GROUNDWATER, CONTAMINATION, BEDROCK CONDITIONS, AQUIFER SEDIMENT CONDITIONS, ANALYSIS		15. NUMBER OF PAGES	
		16. PRICE CODE	
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MEMORANDUM FOR RECORD

81266R34
original

23 December 1975

no
Information
Commerce City, Colo.

SUBJECT: Analysis of Exploratory Drilling Data, RMA

1. An exploratory drilling program was initiated at RMA to gather specific information on the subsurface system. Fifty-four bore holes were drilled along the sections shown on the attached map (Incl 1). The logs from these bore holes (Incl 2) show the nature of the sediment making up the ground water table aquifer, the depth to ground water, and the depth to bedrock. Subsurface cross-sections were constructed from these logs (Incl 3).

2. Bedrock Conditions

The drilling logs show that the bedrock is generally composed of clay/claystone with some sand/sandstone. In bore holes 17, 18, 19, and 20 a notable quantity of sandstone was found in the bedrock. In bore holes 17, 18, and 19 the sandstone formed the top of the bedrock, in bore hole 20 the sandstone was covered by a weathered claystone. In all cases this bedrock sandstone did contain ground water. Sufficient drilling information is not available to determine the extent of this bedrock unit. These data do indicate that it is possible for a bedrock sand unit to be hydraulically linked to the water table aquifer. If such a bedrock sandstone were extensive enough it could act as a confined aquifer obtaining its recharge from the ground water table aquifer. When the comprehensive drilling program is undertaken, detailed logs should be kept on the bedrock to determine the presence and extent of permeable sandstone units.

3. Aquifer Sediment Conditions

a. The sediment above the bedrock was a clayey silty sand. At times some lenses of clean sand were encountered but these units were not extensive. Wells drilled into this type of sediment do not yield sufficient quantities of water for pumping. Also, this type of sediment has a radius of pump well influence of only 5 to 10 meters (Jumikus, 1962). If conventional pump wells were installed the maximum spacing would be 5 to 10 meters unless specific aquifer test data indicated otherwise. Thus, with the data currently available, a conventional well system would not be considered adequate to control ground water flow.

b. A pumping trench will be required if ground water flow is to be controlled. This trench should be dug across the aquifer section. The trench would be backfilled with large gravel around perforated pipe. The perforated pipe would drain to a collection point or points where the water would be pumped for containment/treatment. The placement of such a pumping trench is dependent upon ground water movement and the concentration of suspected contaminants in the system. The depth of the trench is dependent upon the depth of contamination in the system.

4. Subsurface Cross Section Analysis

a. An analysis of cross sections O-O', P-P', and Q-Q' taken across the bedrock draw south of Basin C show that the bedrock channel narrows and becomes more "V" shaped to the south (X-Sec Q-Q'). The saturated portion of the sediment is more to the southwest (left side of X-Sections) than indicated by the USGS map data (Konikow, 1975). These data indicate that ground water flow coming from the Basin A area tends to flow more toward the west and northwest, even more so than indicated on the USGS ground water contour map. If such a volume of ground water is moving to the northwest, then the quantity of flow to the northeast from the Basin F area may be smaller than expected. If this flow is not small then some other flow conditions may be sustaining flow. Currently, not enough detail information is available to assess these flow conditions. These conditions should be noted and further evaluated as more data becomes available.

b. Another notable feature is shown on X-Sections P-P' and Q-Q'. Bore holes 7 and 16 were drilled immediately northwest and southeast of Basin B. The ground water table in these holes shows the capillary rise associated with Basin B. Water stands in Basin B even after long dry periods. This is a surface expression of ground water. Basin B water is also augmented by surface run-off water principally from the Basin A area, along the ditching between these basins.

c. Bore hole 12, X-Section Q-Q' shows a depressed ground water condition. This depression in the ground water table is probably due to increased permeability in this part of the aquifer. The drilling log for bore hole 12 also shows a higher sand content with less fines indicating a higher permeability. This again indicates more flow on the southwest side of the aquifer channel.

d. X-Section R-R' was drilled southeast of Basin A. The complete section has been broken into sub-sections as marked on Inclosure 1. X-Section R-RT₁ shows the ground water table to the southwest side of the section. This portion of the section is close to Upper Derby Lake and indicates that infiltration from the lake may be providing a good portion of the ground water

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recharge in this area. From USGS model work, Phase I, the recharge attributed to the lakes and industrial activities was determined to be 55 GPM. To further define this flow quantity, ground water level changes in this area should be compared to lake level changes. If Upper Derby Lake is the principal recharge source for ground water under Basin A, the level of this lake should be kept low to reduce the flow of ground water under Basin A.

e. No water was noted in the remainder of X-Section R-RT₁, nor in X-Section RT₁-RT₂. X-Section RT₂-R' contained water in bore hole 39 with indications of some water in bore hole 40. These bore holes correspond to the lowest section of the bedrock high northeast of Basin A. Map data and Konikow's chloride model work (Incl 4) indicates that this part of the bedrock high could be flooded by ground water from under Basin A. The presence of water in these borings indicates that flooding has or is occurring. Verification of this overflow can be obtained by drilling a bore hole 500 feet northeast of bore hole #39 (Incl 4). If overflowing of this bedrock high is still occurring, a sample of ground water from the verification bore hole should be taken for analysis. This analysis will determine if any of the contaminants suspected in the Basin A area are moving into the First Creek drainage system at this point.

f. Cross-Section S-S' was taken along the north boundary of the Arsenal. This section shows a depression in the bedrock surface under the bog, as well as under the existing First Creek channel. If contaminants are stratified in the ground water system, depressions such as these could provide undetected conduits for movement of contaminants. A lysimeter system should be placed near the location of bore hole 50, south of the bog. Lysimeters should be located at the bottom of the aquifer, the middle, and near the top. Analysis of these samples will show contaminant movement at all depths.

g. West of the bog the bedrock surface forms a mound with bore hole #47 at the apex. Comparison of the water monitor plan DIMP map to this portion of the cross section shows that the highest concentration of DIMP coincides with the bedrock mound. This could be an indication of stratification. Also, the ground water contours (Konikow, 1975) are more closely spaced in this part of the section, indicating a higher velocity of flow (assuming constant transmissibility), than in the eastern part of the cross section. A lysimeter has been proposed for placement near bore hole 47. If this system was placed near the location of bore hole 45, the increased velocity effect as well as stratification could be evaluated.

h. Besides the above data these cross sections show the bedrock configuration with sufficient accuracy to establish cost estimates for barriers placed

at these sections. These cross sections can also be used to compute section areas, ground water velocity, and ground water discharge rates.

5. Conclusions

a. All drilling done at RMA should be accurately logged, especially the bedrock conditions. This logging is being done for the SGO drilling program and should be continued when the comprehensive drilling work is done.

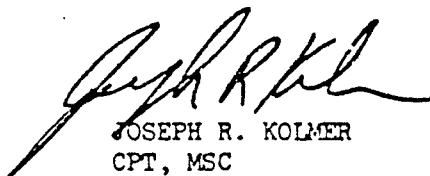
b. Data bearing on ground water flow conditions under Basins C, D, E, and F should be assembled and correlated to more accurately determine how the ground water flow from Basin A distributes to the north. These data include the depth to ground water each time a water sample is taken for analysis, the physical conditions of each monitor well (i.e., depth of well, casing depth, well screen length and depth, etc), and the water monitor plan results. These data are in the process of being gathered. Computer simulations of flow is being done by USGS and this data, intergated with the chemical data, will be useful. Also accurate logging for depth to water and depth to bedrock during the comprehensive drilling program should be done, especially in the Basins area.

c. The monitoring of ground water levels from the sampling wells as well as other wells north of Upper Derby Lake should be done. At the same time the level of Upper Derby Lake should be monitored. Correlation of these data would indicate how much the ground water system under Basin A is being recharged by Upper Derby Lake.

d. A verification hole should be drilled 500 feet northeast of bore hole 39 (Incl 1) to determine if ground water is breeching the bedrock high. This hole should be drilled during a period of high ground water. If water is found it should be analyzed under the existing water monitoring plan.

e. Position two lysimeter sampling systems along the north boundary, one system near the location of bore hole 50 immediately south of the bog, and one near the location of bore hole 45 (Incl 1). Three lysimeters should be placed at each point, one near the bottom of the aquifer, one in the middle, and one at the top. Samples from these lysimeters should be analyzed under the existing water monitoring plan. These lysimeter sampling points are currently being considered in conjunction with other sampling points in the RMA off post contamination plan revision.

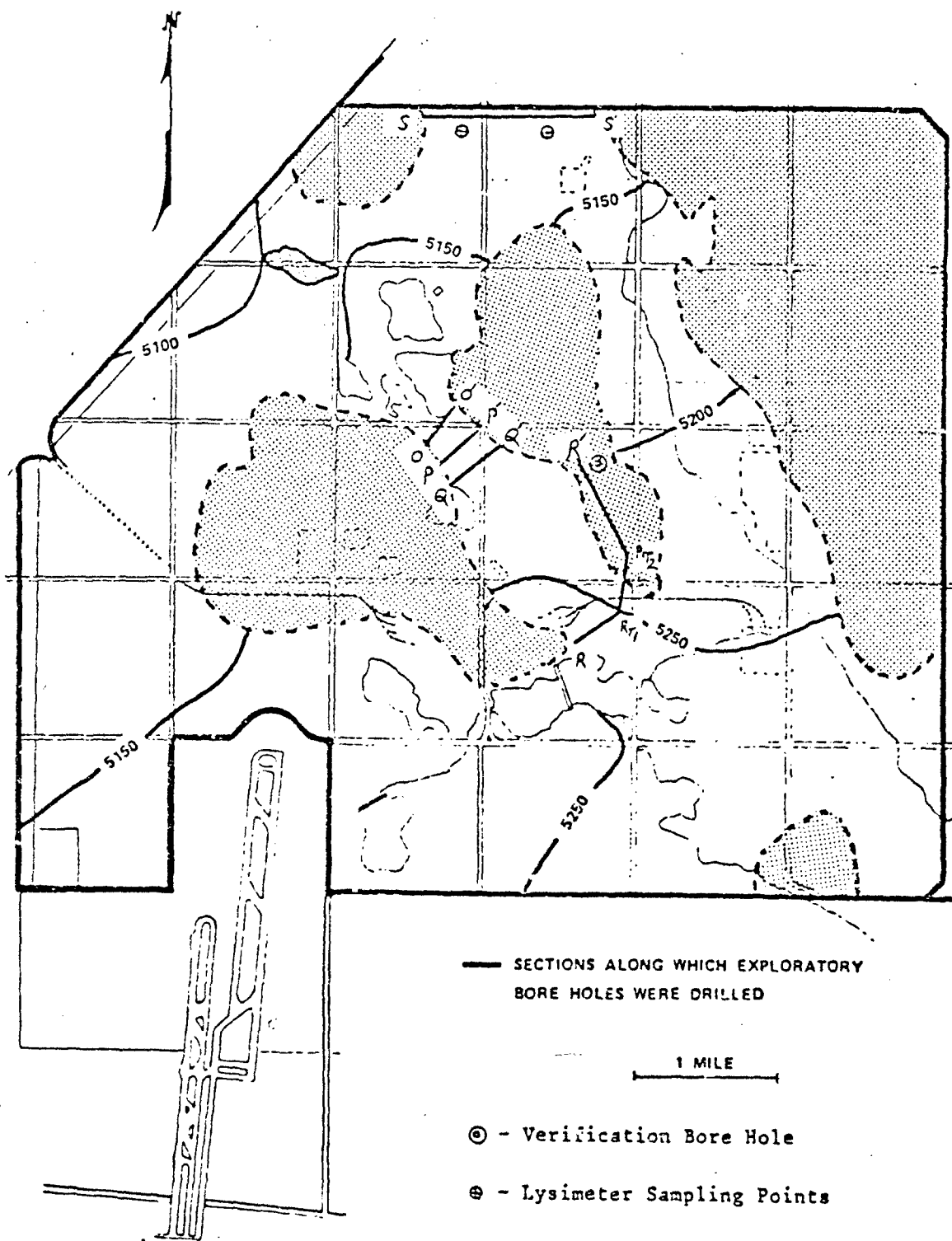
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as



JOSEPH R. KOLMER
CPT, MSC
Technical Support Division

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1. Jumikis, A.R., 1962, Soil Mechanics, D. Van Nostrand Company, Inc., Princeton, NJ.
2. Konikow, L.F., 1975, Hydrogeological Maps of the Alluvial Aquifer in and Adjacent to the Rocky Mountain Arsenal, Colorado, US Geological Survey, Open-File Report 74-342.
3. Konikow, L.F., 1975, Modeling Solute Transport In Ground Water, presented at the International Conference on Environmental Sensing and Assessment, 14 September 1975.



EXPLORATORY BORE LOCATION PLAN

Incl 1

KAL ZEPF AND ASSOCIATES
Consulting Soil Engineers

14967
Proj. No. 14967 Proj. Name AL197-100 Date 10-28-75
Hole No. 1 Hole Elev. 5211-20 Hole Depth 27.0
Hole Type P/H Sample Types A/G - 100 L/L
Depth to Bedrock 22.6 Depth to W.T. NE Field Eng. Rich
Ground Water Observation _____

CLASSIFICATION OF LAYERS

[illegible]

PENETRATION TEST RESULTS

[illegible]

Proj. No. 14962 Proj. Name AL-6210 E2, 142, 240 Date 10-28-75

Hole Type P/A Sample Types P/S - Log hole

Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Solid Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 11967 Proj. Name NIP 10 E.O. 12,430 Date 11-28-75
Hole No. 3 Hole Elev. 5242.5 Hole Depth 23.0
Hole Type P/A Sample Types A/S - Low 1-100
Depth to Bedrock 2.1 Depth to W.T. 11.5 Field Eng. W.H.
Ground Water Observation None

CLASSIFICATION OF LAYERS

Depth		Soil Symbol
from	to	Soil Description
0.0	0.6	(I)
0.6	19.0	CL (II) mod moist - sandy V. CL + V. sandy @ 2.0 to 4 Sandy + moist @ 4.6 V. moist @ 6.0
19.0	20.6	CH (III)
20.6	23.0	CH (IV)
		H @ 2.0
		H @ 6.6
		H @ 11.0
		H @ 19.0
		H @ 20.6

PENETRATION TEST RESULTS

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 11763 Proj. Name MINE 330 E2, 192-50 Date 10-27-75
Hole No. 4 Hole Elev. 5220 - 1st Hole Depth 15.0
Hole Type P/S Sample Types A/S - Log 4/10 -
Depth to Bedrock 17.6 Depth to W.T. 7.0 Field Eng. Wick
Ground Water Observation 4/10

Depth		Soil Symbol		Soil Description
from	to			
0.0	0.5		(1)	
0.5	2.0	SC	(7)	moist - c/p sand - silty.
2.0	11.6	CL	(6)	moist - SANDY
				c/cr. Yellow @ 5.6 ft 2.0
				" SAND + U.C.L. + moist @ 7.0 ft
				" moist @ 10.0
11.6	14.0	C/H	(9)	
14.0	15.0	C/L	(11)	
				H @ 2.0 H @ 11.6
				H @ 5.6 H @ 14.0
				S @ 7.0
				H @ 10.0

[illegible]

.S. - 2"o.d.Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name MA-082 E2.131.960 Date 10-29-75
Hole No. 5 Hole Elev. 5224.2 Hole Depth 35.0
Hole Type D/A Sample Types A/S - Log hole
Depth to Bedrock 30.0 Depth to W.T. 23.6 Field Eng. Rich
Ground Water Observation 23.6

CLASSIFICATION OF LAYERS

Depth from	to	Soil Symbol	Soil Description
0.0	0.7		(1)
0.7	2.6	SC	(7) med moist - clayey - silty
2.6	7.6	SPA	(7) moist
7.6	9.0	SC	(7) med - silty
9.0	30.0	CL	(7) med - U. SANDY - silty
			U/ small layer of gravel @ 32.6
30.0	35.0	CH	(11)
			NOT TO much water
			C @ 2.6 H @ 22.6
			S @ 7.6 S @ 23.0
			H @ 9.0 H @ 30.0
			H @ 13.6
22.6	23.6	K.G.M	

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S - Shelby Tube Sample. Cal. - California Spoon. S.T. - Shelby Tube

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Proj. No. 14767 Proj. Name N185.200 E2.122.200 Date 10-27-55
Hole No. 6 Hole Elev. 5225.2 est Hole Depth 50.0
Hole Type D/A Sample Types A/S - 1st 4th
Depth to Bedrock 47.0' Depth to W.T. 19.0 Field Eng. W.H.
Ground Water Observation None

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	2.0		(2) moist - clay - sandy
2.0	5.6	SC	(7) moist - silty
5.6	13.6	SM	(7) moist
13.6	47.0	CL	(6) wet - U. sandy - silty
47.0	50.0	CH	(2)
			1st to mud water
			small sand in hole
			S @ 2.0 H @ 47.0
			S @ 5.6
			H @ 13.6
			H @ 22.6
			S @ 37.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tub

KAL ZEPF AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name NIS 390 ES 162 400 Date 10-30-75
 le No. 7 Hole Elev. 522.5 ft Hole Depth 45.0
 Hole Type P/A Sample Types H/S - 200 1/2
 Depth to Bedrock 41.0 Depth to W.T. 17.6 Field Eng. Pick
 Ground Water Observation ~~45.0~~

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
From	to	Symbol	
0.0	0.7		(1)
0.7	4.0	CL	(2) moist - U. SAND - silty
4.0	9.6	SC	(3) moist - U. moist - silty
9.6	19.0	CL	(4) moist - U. SAND - silty
19.0	23.0	SC	(5) moist - silty - clayey - silty
23.0	29.6	CL	(6) moist - U. SAND - silty
29.6	41.0	SC	(7) moist - silty - w/ small layer of sand
41.0	45.0	CH	(8) @ 37.0 to 41.0
			LOTS OF WATER
			small odor in hole
			S @ 4.0
			H @ 9.6
			S @ 19.0
			H @ 23.0
			S @ 29.6
			H @ 37.0
			S @ 37.6
			H @ 41.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

Consulting Soil Engineers

Proj. No. 14967 Proj. Name NIKE SCOT E2182 650 Date 10-30-75
 Hole No. 8 Hole Elev. 5275 Hole Depth 45.0
 Soil Type P/A Sample Types A/S - Log 1st
 Depth to Bedrock 40.6 Depth to W.T. 23.0 Field Eng. Pick
 Ground Water Observation Yes

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.6		(1)
0.6	2.0	SC	(1) med moist - clayey - silty
2.0	5.0	SM	(2) med moist
5.0	7.6	SC	(3) med moist - light clayey - silty
7.6	18.6	CL	(4) wet - sandy - silty
18.6	35.6	SC	(7) wet - silty
			slightly clayey @ 30.0 to 35.6
35.6	40.6	CL	(6) wet - v. sandy - silty
40.6	41.6	CH	(10)
41.6	45.0	CH	(11)
			LOTS OF WATER
			H @ 5.0 S @ 30.0
			H @ 7.6 H @ 35.6
			H @ 9.6 H @ 40.6
			S @ 18.6 H @ 41.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

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Consulting Soil Engineers

Proj. No. 14767 Proj. Name N 125 625 E2112426 Date 12-21-77
 Is No. 9 Hole Elev. 5221.2 est Hole Depth 30.0
 Hole Type P/A Sample Types A 1/2 - 1 - 1 1/2
 Depth to Bedrock 26.0 Depth to W.T. 12.0 Field Eng. K. J.
 Ground Water Observation P

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7	(7)	
0.7	2.0	CL (6)	WIST - U. SANDY - SILTY
2.0	7.0	SC (7)	WIST - SILTY
7.0	12.6	CL (6)	WIST - U. SANDY - SILTY
12.6	26.0	SC (7)	WIST - CLAY - SILTY
			W/ LAYER OF GRAVEL @ 22.0 TO 22.6
26.0	28.0	CH (10)	SILTY CLAYSTONE
28.0	30.0	CH (11)	
			LOTS OF WATER
			SMELL ODOR IN HOLE
			S @ 2.0 H @ 26.0
			H @ 7.0 H @ 28.0
			S @ 12.6
			H @ 22.0
			S @ 22.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Depth		Soil Symbol	Soil Description
From	to		
0.0	2.1		(1)
2.1	9.0	CL	(6) U. moist to wet - sand
9.0	15.6	SC	(7) wet - slight clay - silty
15.6	18.0	CH	(10)
18.0	20.0	CH	(11)
			LOTS OF WATER
			S @ 9.0
			H @ 15.6
			H @ 18.0

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

14967
Proj. No. 14967 Proj. Name NISGAGO E21F3155 Date 10-20-77
to No. 11 Hole Elev. 5231.2 feet Hole Depth 15.1
Hole Type P/A Sample Types A/S - Log hole
Depth to Bedrock 11.6 Depth to W.T. NE Field Eng. ...
Ground Water Observation ...

Depth		Soil Symbol	Soil Description
From	To		
0.0	0.6	(1)	
0.6	1.6	SC	(7) med moist-silty - c/hgss
1.6	4.6	SM	(8) med moist
4.6	7.6	SC	(9) moist - c/hgss - silty
7.6	11.6	CL	(10) unmoist f. clay - 1/2 sand - silty
11.6	12.0	CH	(10)
14.0	15.0	CH	(10)
			S @ 1.6
			H @ 4.6
			H @ 7.6
			H @ 11.6
			H @ 14.0

[illegible]

Proj. No. 14967 Proj. Name N134.270 F2.152.220 Date 10-29-75

hole type P/A Sample Types A/S - Log hole

Depth to Bedrock 28.0 Depth to W.T. NE Field Eng. Rich

Ground Water Observation

Depth		Soil Symbol	Soil Description
From	To		
0.0	0.7		(1)
0.7	14.6	JM	(1) hard moist
14.6	17.0	CL	(1) H. moist - sandy
17.0	19.0	SC	(1) moist - silty
19.0	28.0	CL	(1) H. moist - sandy
28.0	30.0	CH	(1)
			H @ 6.0
			C @ 14.6
			H @ 19.0
			H @ 28.0

[illegible]

S.S. - 2" o.d. Solid Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name N184,500 E21-22-410 Date 10-29-75
 to No. 13 Hole Elev. 5241.8 Hole Depth 40.0
 Hole Type P/H Sample Types A/S - Log hole
 Depth to Bedrock 37.0 Depth to W.T. 22.0 Field Eng. Kal
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
from	to		
0.0	2.7		(1)
0.7	16.0	SM	(2) mixed moist moist @ 12.0
16.0	29.0	SC	(3) wet - silty - clayey
29.0	37.0	CL	(4) wet - v. silty - silty
37.0	40.0	CH	(5)
			NOT too much water
			S @ 9.0
			H @ 16.0
			S @ 26.0
			S @ 29.0
			H @ 37.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

Proj. No. 14767 Proj. Name N 180, 450 52, 132, 700 Date 10-29-75
Hole No. 14 Hole Elev. 5238 Hole Depth 50.0
Hole Type P/A Sample Types H/S - Log 1.10
Depth to Bedrock 42.0 Depth to W.T. 17.6 Field Eng. P.H.
Ground Water Observation _____

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.6		(1)
0.6	2.0	SC	(1) med moist - silty
2.0	26.0	SM	(2) med moist
			moist @ 12.0
26.0	42.0	SC	(1) wet - clayey - silty
42.0	50.0	CH	(1)
			NOT TO much WATER
			S @ 7.6
			H @ 26.0
			H @ 42.0

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name 11-760 F2182690 Date 11-29-75
 Hole No. 15 Hole Elev. 523.22 Hole Depth 65.0
 Hole Type P/A Sample Types A/S - 120 Lbs
 Depth to Bedrock 56.0 Depth to W.T. 18.6 Field Eng. Pick
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
From	to	Symbol	
0.0	2.6	(1)	
0.6	2.6	SC	(7) med moist - silty - clayey
2.6	17.0	SM	(7) med moist
			moist @ 9.0
			W.T. @ 13.6
17.0	30.0	SC	(7) wet - slightly clayey - silty
30.0	42.6	SM	(7) wet
42.6	56.0	SC	(7) wet - slightly clayey - silty
56.0	60.0	CH	(II)
			NOT TO much WATER
			S @ 13.6
			H @ 17.0
			H @ 42.6
			H @ 56.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

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Consulting Soil Engineers

Proj. No. 17967 Proj. Name W84-60 Date 10-27-75
Hole No. 16 Hole Elev. 5233.0 Hole Depth 60.0
Hole Type P/A Sample Types H/S - Log hole
Depth to Bedrock 56.0' Depth to W.T. 12.6' Field Eng. McL
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	To		
0.0	5.5		U
5.5	12.6	SC	⑦ med. moist - silty - c/lay. clay wet + slightly c/lay. to 5.6
12.6	21.0	SM	⑧ med. moist
21.0	39.6	SC	⑨ unit - c/lay. - silty
39.6	56.0	SM	⑩ unit
			us/sec. Humid @ 50.1 to 51.0
56.0	60.0	CH	⑪
			unit to much water
			c @ 5.6 H @ 50.1
			H @ 21.0 S @ 56.0
			H @ 26.0 H @ 57.6
			c @ 34.6
			H @ 40.6

PENETRATION TEST RESULTS

[illegible]

S.S. - 2"o.d.Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 41967 Proj. Name NIRU 170 E2183.000 Date 10-30-75
 to No. 17 Hole Elev. 5236.0 Hole Depth 50.0
 Hole Type A/A Sample Types A/S - 200 hole
 Depth to Bedrock 46.0 Depth to W.T. 21.0 Field Eng. Kiel
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Length		Soil Symbol	Soil Description
From	to		
0.0	0.7		(1)
0.7	1.6	SC (7)	mod moist - slightly clayey - silty
1.6	11.0	SM (7)	mod moist
11.0	14.0	SC (7)	mod moist - slightly clayey - silty
14.0	37.0	SM (7)	mod moist
37.0	46.0	CL (6)	mod moist - 11. sandy - silty
46.0	49.0	SM (13)	with small pockets of clay - tone
49.0	50.0	CH (11)	
			LOTS OF WATER
			H @ 11.0 H @ 46.0
			S @ 14.0
			H @ 27.0
			H @ 37.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14767 Proj. Name N135.085 E2.183,150 Date 10-29-75
 to No. 18 Hole Elev. 5236.0 est Hole Depth 35.0
 Hole Type P/P Sample Types H/S - Lsa 1.1e
 Depth to Bedrock 29.6 Depth to W.T. 17.0 Field Eng. 44
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.6		(1)
0.6	14.0	SC	(7) med moist - C/Hsg - silty moist @ 6.0
14.0	18.6	SM	(7) wet
18.6	21.0	SC	(7) wet - slightly C/Hsg - silty
21.0	26.0	CL	(8) wet - U. sandy
26.0	29.6	SC	(7) wet -
29.6	32.6	SM	(13)
32.6	35.0	CH	(11)
			17.0 T5 much water
			H @ 6.0
			H @ 15.6
			H @ 29.6
			H @ 32.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

2.3. - 2" O.D. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14757 Proj. Name NILES E2, 183, 340 Date 10-29-75
Hole No. 17 Hole Elev. 5235.9 Hole Depth 30.0
Hole Type 2/H Sample Type A/S Loc. 1/c
Depth to Bedrock 20.6 Depth to W.T. 16.6 Field Eng. K-Z
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.6		(1)
0.6	2.6	SC	7. med moist - silty
2.6	6.0	SM	6. med moist
6.0	15.0	SC	2) unit - slight 1/4 clayey more clay @ 10.0
15.0	20.6	CL	6) unit - sandy
20.6	26.0	SM	13) unit
26.0	30.0	CH	(11)
			LOTS OF WATER
			small eddy in hole
			S @ 6.0 H @ 26.0
			H @ 10.0
			S @ 15.0
			H @ 20.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" d Soil Spoon Sample. Cal. - California Spoon S.T. - Shelby Tube

KAL ZEPF AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14767 Proj. Name N 185 470 E 2, 123, 675 Date 10-27-75
Hole No. 20 Hole Elev. 5245.20st Hole Depth 40.0
Hole Type P/H Sample Types H/S - 200 hole
Depth to Bedrock 5.6 Depth to W.T. 15.6 Field Eng. Ric /
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.6		(1)
0.6	4.0	SC	(7) 17.1 moist to moist Layer of clay + sand
4.0	5.6	CL	(5) moist to v. moist
5.6	9.6	SM	(10) moist moist to moist
9.6	36.0	SM	(13) wet @ 14.0
36.0	38.0	CH	(11)
38.0	40.0	CH	(15) blue shale
			LOTS of water
			Small holes in hole
			S @ 4.0 H @ 35.0
			S @ 5.6 H @ 38.0
			H @ 9.6
			V. H @ 25.6
			S @ 27.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tub

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Proj. No. 1-1967 SPC E 211/200
Proj. Name N 179,500 Date 10-29-75
Hole No. 21 Hole Elev. 521.24 ✓ Hole Depth 25.0
Hole Type P/- Sample Types A/S - Log hole
Depth to Bedrock 18.0 Depth to W.T. 11.6 Field Eng. Pic
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.6	(7)	
0.6	2.6	SC (7)	moist - silty slightly clayey @ 1.6 to 2.6
2.6	5.0	SM (7)	moist
5.0	18.0	SC (7)	moist - clayey - slightly clayey wet @ 7.0
18.0	25.0	CH (11)	
			LOTS OF WATER
			S @ 1.6 H @ 19.6
			H @ 2.6
			S @ 7.0
			H @ 18.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tub

Proj. No. 14967 Proj. Name N 186, 100 E 2, 186, 100 Date 10-29-75

Hole Type P/A Sample Types A/S - Log hole

Depth to Bedrock 14.0 Depth to W.T. 17.0 Field Eng. Rich

Ground Water Observation

Depth		Soil	
From	To	Symbol	Soil Description
0.0	5.6	(F)	MIST - C/AZ - SANDY
5.6	14.0	CL	(L) WET - V. SANDY
14.0	16.6	CH	(D)
16.6	20.0	CH	(H)
			NOT TO much WATER
			C @ 5.6
			H @ 14.0
			H @ 16.6

[illegible]

Proj. No. 14967 Proj. Name W-7 Date 12-29-75
 Le No. 23 Hole Elev. 6265.2 Hole Depth 15.0
 Hole Type P/A Sample Types A/S - Log hole
 Depth to Bedrock 10.6 Depth to W.T. ~~7.2~~ 8.6 Field Eng. Rink
 Ground Water Observation

[illegible][illegible]

Cal. - California Spoon, S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name NIJ 70 FR 187-200 Date 10-29-75

Hole No. 24 Hole Elev. -27.2 est Hole Depth 10.0

40 Type P/A Sample Types A/S - 1st hole

Depth to Bedrock 8.0 Depth to W.T. 62 Field Eng. Rich

Ground Water Observation

CLASSIFICATION OF LAYERS

[illegible]

PENETRATION TEST RESULTS

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

14967
Proj. No. 14967 Proj. Name W.T. 207 E2102 350 Date 10-29-75
Hole No. 25 Hole Elev. 5246⁰ feet Hole Depth 10.0
Hole Type P/A Sample Types A/S - Log Hole
Depth to Bedrock 8.0 Depth to W.T. NE Field Eng. Rich
Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name W/100000 E2.147.005 Date 10-20-75
Hole No. 26 Hole Elev. 5263' est Hole Depth 10.0
Hole Type P/A Sample Types A/S - 1.0 1.1
Depth to Bedrock 8.6 Depth to W.T. NE Field Eng. Pic/
Ground Water Observation _____

[illegible][illegible]

S.S. - 2"o.d.Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name 111-0-100 02, 1977 Date 12-27-75
Hole No. 27 Hole Elev. 2212.2 est Hole Depth 15.0
Core Type P/A Sample Types A/S - 200 hole
Depth to Bedrock 7.0 Depth to W.T. NE Field Eng. W. H.
Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 141767 Proj. Name N150.910 E2.187.975 Date 11-29-75
 to No. 28 Hole Elev. 5262.0 cat Hole Depth 150
 hole Type P/A Sample Types A/S - log hole
 Depth to Bedrock 8.0 Depth to W.T. NE Field Eng. PL-1
 Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name N21, 200 Date 10-27-75
Hole No. 29 Hole Elev. 5582 Hole Depth 10.0
Hole Type P/A Sample Types A/S - 1st hole
Depth to Bedrock 6.6 Depth to W.T. NE Field Eng. in
Ground Water Observation _____

[illegible][illegible]

S.S. - 2nd - 2-11-68 - Santa Ana Cal - California State S M Shelby, Mike

Consulting Soil Engineers

Proj. No. 12967 Proj. Name N181-50 E2, 181-925 Date 10-27-78
Hole No. 30 Hole Elev. 1253.0 est Hole Depth 10.0
Hole Type P/A Sample Types HF - 100 1.0/0
Depth to Bedrock 5.0 Depth to W.T. N/E Field Eng. W. H.
Ground Water Observation _____

CLASSIFICATION OF LAYERS

[illegible]

PENETRATION TEST RESULTS

[illegible]

S.S. - 2"o.d.Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name NI87-075 ES-37-075 Date 10-27-71
Hole No. 31 Hole Elev. 5249.22 Hole Depth 10.0
Hole Type P/A Sample Types A/S - 100' below
Depth to Bedrock 6.0' Depth to W.T. -11E Field Eng. W. J.
Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name N 182.450 E 2.137.975 Date 10-22-57
Hole No. 32 Hole Elev. 5247.2 Hole Depth 15.0
Hole Type D/H Sample Types N/S - 100 1.0
Depth to Bedrock 10.0' Depth to W.T. N/E Field Eng. 1-1
Ground Water Observation _____

CLASSIFICATION OF LAYERS.

[illegible]

PENETRATION TEST RESULTS

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14767 Proj. Name N 182750 E 21271975 Date 10-22-75
Hole No. 33 Hole Elev. 52510 est Hole Depth 15.0
Hole Type P/A Sample Types A/S - Log 1/10
Depth to Bedrock 12.6 Depth to W.T. NE Field Eng. P. L.
Ground Water Observation _____

[illegible][illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 141967 Proj. Name N183.020 E21127.730 Date 12-20-20
Hole No. 34 Hole Elev. 5255' ± Hole Depth 20.0
Hole Type P/A Sample Types A/S - Log. 1.10
Depth to Bedrock 16.0' Depth to W.T. NE Field Eng. 20.1
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	
from	to	Symbol	Soil Description
0.0	0.3	(1)	
0.3	2.0	SC	Dry moist - slight clayey - U sil
2.0	9.0	SM	(D) med moist
			moist 6.6
9.0	16.0	CL	(D) 1/2 moist - sandy
16.0	18.0	CH	(D)
18.0	20.0	CH	(D)
			S @ 6.6
			H @ 9.0
			H @ 16.0
			H @ 18.0

PENETRATION TEST RESULTS

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14962 Proj. Name N 183,350 E2,137,425 Date 10-30-75
 1c No. 35 Hole Elev. 5261.2 at Hole Depth 20.0
 Hole Type P/A Sample Types R/S - Log hole
 Depth to Bedrock 19.0 Depth to W.T. NE Field Eng. PLH
 Ground Water Observation _____

[illegible][illegible]

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Proj. No. 14967 Proj. Name W183.600 E2.187.180 Date 10-20-75
Hole No. 36 Hole Elev. 5261.2 est Hole Depth 22.0
Hole Type P/A Sample Types H/S - 1.0 1.1e
Depth to Bedrock 16.0 Depth to W.T. 11.5 Field Eng. W. L.
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.4		(1)
0.4	16.0	SC (7)	med. moist - silty clay - 1.0 to 1.1e USL Manual 6.6 to 9.6
16.0	17.6	CH (12)	
17.6	20.0	CH (11)	
			small order in hole
			V. H @ 6.6
			S @ 9.6
			H @ 16.0
			H @ 17.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tub

Proj. No. 14767 Proj. Name 1103, 125 E2, 126, 127 Date 10-30-75
Hole No. 37 Hole Elev. 5253.2 est Hole Depth 20.0
Is Type P/A Sample Types A/S - 2 in hole
Depth to Bedrock 10.0 Depth to W.T. NE Field Eng. 2:1
Ground Water Observation _____

Depth		Soil	Soil Description
From	to	Symbol	
0.0	0.4	(1)	
0.4	5.0	SC (7)	med moist - slightly clayey - U: 17%
5.0	10.0	GW (9)	1st moist - sandy
10.0	13.6	SM/CL (10)	
13.6	20.0	CH (11)	
EXPENSES - 1 4" Auger 1 Rock Bit			
U: 11 @ 5.0			
S @ 10.0			
H @ 13.6			

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name N18W, L20 E2, 186, L20 Date 12-30-75
Hole No. 38 Hole Elev. 5253.0 at Hole Depth 25.0
Hole Type P/A Sample Types H/S - Log h, 1c
Depth to Bedrock 19.6 Depth to W.T. NE Field Eng. Mich
Ground Water Observation _____

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.4		(I)
0.4	2.0	SC	(I) mod moist - slightly c/hy - v. silty
2.0	10.0	SM	(I) mod moist
10.0	12.0	SC	(I) mod moist - slightly c/hy - silty
12.0	19.6	CL	(I) moist - sandy
			w/o gravel @ 13.6 to 17.0
19.6	25.0	CH	(II)

4 6 6

14 @ 12.0

H @ 13.6

H @ 18.6

H @ 24.0

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tub

Proj. No. 14967 Proj. Name N184.475 E2,136.350 Date 11-29-77
Hole No. 39 Hole Elev. 5229.4 Hole Depth 30.0
Hole Type P/A Sample Types H/- - Log 1.1/5
Depth to Bedrock 24.0 Depth to W.T. NE Field Eng. 11-1
Ground Water Observation _____

Depth		Soil Symbol	Soil Description
from	to		
0.0	1.2	(D)	
0.3	11.0	SM (S) med moist	
11.0	13.0	SC (S) med moist - U. silty - slightly clayey	
13.0	24.0	CL (6) U. moist - sandy-silty	
24.0	30.0	CH (H)	
			H @ 11.0
			H @ 12.0
			S @ 13.0
			H @ 17.0
			H @ 24.0

[illegible]

S.S. - 2"o.d.Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name NISU 720 E2, 124, 060 Date 10-28-75
 Hole No. 110 Hole Elev. 6256.2 Hole Depth 25.0
 Hole Type P/H Sample Types H/S - 200 1-1e
 Depth to Bedrock 23.6 Depth to W.T. NE Field Eng. PH
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
From	to	Symbol	
0.0	0.4		①
0.4	1.0	SC (7)	st moist - v. silty - slight clay
1.0	11.0	SM (7)	med moist
11.0	14.0	SC (7)	med moist - slight clay - v. silty
14.0	23.6	CL (6)	moist - sandy - silty
			v. moist @ 15.0
			w/oc. sand @ 19.0 to 21.0
23.6	25.0	CH (10)	
			H @ 6.0
			H @ 11.0
			H @ 14.0
			H @ 23.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14967 Proj. Name N185.100 F 2, 145, 760 Date 12-30-75
 Is No. 41 Hole Elev. 5259.0 est Hole Depth 25.0
 Hole Type P/T Sample Types H/S - 200 hole
 Depth to Bedrock 23.6 Depth to W.T. NE Field Eng. PK
 Ground Water Observation _____

[illegible][illegible]

Consulting Soil Engineers

Proj. No. 14767 Proj. Name _____ Date 10-30-75
 Hole No. 42 Hole Elev. _____ Hole Depth 20.0
 Hole Type P/A Sample Types H/S - Log hole
 Depth to Bedrock 17.0 Depth to W.T. 17.0 Field Eng. PAH
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		(1)
0.7	17.0	CL (6)	MOIST - SANDY to U SANDY
			U. MOIST @ 3.0
			WET + some weathered @ 14.0
17.0	20.0	CH (12)	
			NOT TO much WATER
			H @ 5.0
			H @ 17.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 12-22-75
 Hole No. 43 Hole Elev. _____ Hole Depth 20.0
 Hole Type P/A Sample Types A/S - Log hole
 Depth to Bedrock 18.6 Depth to W.T. 10.6 Field Eng. P.H.
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.7		(D)
0.7	9.6	CL	(B) moist - U. SANDY - SILTY U. moist - $\frac{1}{2}$ - C 3.0
9.6	15.0	SC	(7) WET - slightly clayey - SILTY
15.0	18.6	CL	(6) WET - U. SANDY - SILTY
18.6	20.0	CH	(10)
			LOTS of WATER
			U. soft @ 9.6 to 15.0
			H @ 15.0
			H @ 18.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

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Proj. No. 14967 Proj. Name _____ Date 10-30-75
 to No. 45 Hole Elev. _____ Hole Depth 25.0
 Hole Type P/H Sample Types H/S - Log hole
 Depth to Bedrock 19.0 Depth to W.T. 13.6 Field Eng. R. J. /
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		(1)
0.7	2.6	SC	(2) Dried moist - clayey - silty
2.6	13.0	CL	(6) U. moist - sandy - silty
13.0	17.6	SC	(7) wet - slightly clayey
17.6	19.0	CL	(6) wet - U. sandy - silty
19.0	25.0	CH	(10)
			LOTS OF WATER
			5 @ 9.0
			5 @ 13.0
			H @ 17.6
			H @ 19.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

1 - 2" - 4" Split Spoon Sample Cal. - California Spoon S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14947 Proj. Name _____ Date 12-30-75
 Hole No. 41 Hole Elev. _____ Hole Depth 25.0
 Hole Type P/A Sample Types H/A - 2.9 hole
 Depth to Bedrock 22.0 Depth to W.T. 15.0 Field Eng. P. L.
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	0.7		①
0.7	2.6	CL	⑥ med moist - V. SANDY
2.6	4.6	SM	⑦ med moist
4.6	10.6	CL	⑧ moist - V. SANDY
			V. CAL. + V. moist @ 7.0
10.6	22.0	SP	⑨ med moist
			V. moist @ 13.6
			WET @ 15.0
22.0	25.0	CH	⑪ w/ Layer of Stonezone @ 22.0 to 22.6
			H @ 2.6
			S @ 4.6
			S @ 7.0
			LOTS of WATER
			H @ 10.6
			H @ 22.0
			SMALL ODSR IN HOLE
			H @ 22.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2"o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-32-75
 Hole No. 47 Hole Elev. _____ Hole Depth 20.0
 Hole Type P/A Sample Types H/S - Log hole
 Depth to Bedrock 18.0 Depth to W.T. 11.0 Field Eng. Rich
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		①
0.7	4.0	CL	⑥ moist - U. SANDY
4.0	6.0	SC	⑦ moist
6.0	9.0	CL	⑥ U. moist - U. SANDY
			U. cal. @ 7.6 to 9.0
9.0	11.0	SC	⑦ U. moist
11.0	16.0	SM	⑧ moist
			WET @ 12.6
16.0	18.0	SW	⑨ WET - w/ cc. gravel
18.0	20.0	CH	⑩
			LOTS OF WATER
			SMELL ODOR IN HOLE
			H @ 4.0 H @ 16.0
			S @ 6.0 H @ 18.0
			H @ 9.0
			S @ 11.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-30-75

to No. 48 Hole Elev. _____ Hole Depth 20.0

Hole Type P/A Sample Types: A/S - Log Hole

Depth to Bedrock 17.0 Depth to W.T. 10.0 Field Eng. Rich

Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		(1)
0.7	7.6	CL	(1) WET - U. SANDS
7.6	11.0	SC	(1) WET - CLAYES - U. CL.
			slightly clayey @ 9.0 to 11.0
11.0	17.0	SM	(1) Unit
			W/ GRAYOL @ 12.0 to 13.0
17.0	20.0	CH	(1)
			LOTS OF WATER
			Small odor in hole
			S @ 7.6
			H @ 12.0
			S @ 13.0
			H @ 17.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tul

Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-30-75
Hole No. 419 Hole Elev. _____ Hole Depth 20.0
Hole Type P/A Sample Types A/S - Log hole
Depth to Bedrock 15.6 Depth to W.T. 9.6 Field Eng. Rich
Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
From	to	Symbol	
0.0	4.0		(3) moist - clay - sandy
4.0	9.0	CL	(6) wet - 1/2 sand - silty
9.0	15.6	SC	(7) wet - slightly clayey
			more clay + some weathered @
15.6	20.0	CH	(10)
			LOTS OF WATER
			SMELL ODOR IN HOLE
			S @ 4.0
			H @ 14.0
			H @ 15.6

PENETRATION TEST RESULTS

[illegible]

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-30-75

to No. 50 Hole Elev. _____ Hole Depth 35.0

Hole Type P/H Sample Types A/S - Log hole

Depth to Bedrock 34.0 Depth to W.T. 10.0 Field Eng. Pic

Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	8.0		(3) moist - clay - silty
			V. moist @ 5.0
8.0	16.0	CL	(2) wet - V. sandy - silty
16.0	34.0	SM	(1) wet
			silty, gravel @ 32.6 to 33.0
34.0	35.0	CH	(10) -
			LOTS OF WATER
			S @ 5.0
			S @ 16.0
			H @ 32.6
			H @ 34.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-30-75
 Hole No. 51 Hole Elev. _____ Hole Depth 20.0
 Hole Type P/A Sample Types A/S - 20' hole
 Depth to Bedrock 17.0 Depth to W.T. 6.0 Field Eng. Pick
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil Symbol	Soil Description
From	to		
0.0	2.0		(1) moist - clay - sand
2.0	5.0	(2)	(2) moist - 1/2 sandy
5.0	12.0	(3)	(3) moist - clay clay - silt
12.0	17.0	(4)	(4) moist
17.0	20.0	(5)	(5)
			LOTS OF WATER
			H @ 13.0
			H @ 17.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Proj. No. 14767 Proj. Name _____ Date 10-30-75
 Hole No. 52 Hole Elev. _____ Hole Depth 27.0
 Soil Type P/A Sample Types N/S - Log hole
 Depth to Bedrock 25.0 Depth to W.T. 6.6 Field Eng. Rici
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		(1)
0.7	4.0	CL	(6) moist - (1) sand
			11. moist @ 2.6
4.0	25.0	SC	(7) moist - clayey - silty
			slight change @ 9.0 to 12.0
			slight change @ 22.6 to 25.0
25.0	27.0	CH	(11)
			LOTS OF WATER
			S @ 2.6
			S @ 4.0
			H @ 16.0
			H @ 22.6
			H @ 25.0

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

- KAL ZEPP AND ASSOCIATES
Consulting Soil Engineers

Proj. No. 14967 Proj. Name _____ Date 10-30-75
 Is No. 53 Hole Elev. _____ Hole Depth 33.0
 Hole Type P/A Sample Types H/S - 200 hole
 Depth to Bedrock 30.0 Depth to W.T. 16.6 Field Eng. Pick
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
from	to	Symbol	
0.0	0.7		①
0.7	15.0	Sm	② med moist
			moist @ 3.0
			V. moist @ 7.6
15.0	18.6	sc	③ wet - slightly clayey - V. silty
18.6	30.0	sm	④ wet
			w/med. Humus @ 22.6 to 23.0
			" " " @ 27.6 to 28.6
30.0	33.0	CH	⑤ clayey @ 29.6 to 30.0
			LOTS OF WATER
			H @ 5.0
			H @ 15.0
			S @ 18.6
			H @ 22.6
			S @ 23.0
			H @ 27.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" d Galv. Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

Consulting Soil Engineers

14967
 Proj. No. _____ Proj. Name _____ Date 10-30-75
 No. 54 Hole Elev. _____ Hole Depth 50.0
 Hole Type P/A Sample Types A/S - 200 1.51e
 Depth to Bedrock 45.0 Depth to W.T. 45.0 Field Eng. Rich
 Ground Water Observation _____

CLASSIFICATION OF LAYERS

Depth		Soil	Soil Description
From	to	Symbol	
0.0	0.7		
0.7	13.6	SM (8)	med moist
13.6	18.0	SC (7)	med moist - slightly clayey - v. silty
18.0	21.6	CL (6)	moist - v. sandy - silty
21.6	26.6	SC (7)	moist - silty
26.6	28.6	SW (9)	moist - w/ med. humus
28.6	31.0	SM (8)	med moist
31.0	33.6	SC (7)	moist - w/ med. humus - clayey
33.6	45.0	CL (6)	moist - sandy to v. sandy
45.0	50.0	CH (11)	- WCT @ 42.6
			H @ 13.6 H @ 45.0
			H @ 18.0 S @ 47.6
			H @ 21.6
			H @ 26.6 Lots of water
			S @ 28.6 After 42.6
			H @ 31.0
			S @ 42.6

PENETRATION TEST RESULTS

Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon	Depth	Blow Count	Type of Spoon

S.S. - 2" o.d. Split Spoon Sample. Cal. - California Spoon. S.T. - Shelby Tube

- 1)  TOPSOIL C/Ag - SANDY - SILTY
- 2)  ASPHALT, CONCRETE
- 3)  FILL-clay, sandy cinders (1%), rubble (1%), trash (1%)
- 4)  CLAY, sandy, silty, very soft, very moist, wet, brown
- 5)  CLAY, sandy, silty, medium stiff, lt., med., very moist, wet, brown
- 6)  CLAY, sandy to very sandy, silty, ^{med stiff to} very extremely stiff, lt. to med. to very moist, ^{to} wet, brown - w/ occ. lens
- 7)  CLAY, very sandy to SAND, clayey, soft to stiff, moist, brown, occasionally gravelly ^{to wet}
- 8)  SAND, slightly silty to silty, poorly graded, firm, ^{to} dense, dry, lt. to med. to very moist ^{to} wet, some gravel, ~~cobbles & boulders~~
- 9)  SAND sw / ^{w/ no} GRAVEL, well graded, ~~loose~~, medium dense, ^{to} dense, lt. to med. to very moist ^{to} wet, some ~~cobbles & boulders~~
- 10)  CLAY (severely weathered claystone) ^{SANDSTONE} very stiff, moist
- 11)  CLAYSTONE BEDROCK (Shale), weathered, firm to medium hard, ^{to} hard, moist, yellow, brown, gray - Green
- 12)  CLAYSTONE BEDROCK (Shale), weathered, firm, medium hard, hard, moist, yellow, brown, gray
- 13)  SANDSTONE BEDROCK, weathered, medium hard, hard, some pockets of claystone, yellow-brown
- 14)  SILTSTONE BEDROCK (Shale), weathered, firm to hard,
- 15)  Blue shale BEDROCK (Shale), very hard - CLAYSTONE
- 16)  SANDSTONE-CLAYSTONE BEDROCK (Shale), weathered, firm, hard, yellow-brown
- 17)  SANDSTONE (conglomerate) BEDROCK hard
- 18) 

JOB NO. 14967

IF NO CONTOURS ON SITE PLAN, DESCRIBE TOPOGRAPHY (I.E. LEVEL, SLOPING, ROLLING, HILLY). INCLUDE SLOPE DIRECTION(S), DESIGNATE FEATURES (HILLS, GULLIES, ETC.) ON PLAN sloping IN ALL DIRECTIONS

2. WHAT IS PRESENT USE OF SITE? Rm A
3. TYPE OF VEGETATION ON SURFACE GRASS-weeds
4. ARE THERE SHRINKAGE CRACKS IN SURFACE? NO WIDTH _____ DEPTH _____
5. IS THERE EVIDENCE OR HISTORY OF CUT AND/OR FILL ON THE SITE (DESIGNATE ON PLAN)? YES - Fill + CUT
6. DEPTH OF TOPSOIL (USE SHOVEL TO DETERMINE) 0.3 to 0.7
7. ARE THERE ANY PONDS, CREEKS, SEEPS, IRRIGATION DITCHES, OR OTHER EVIDENCE OF WATER (DESIGNATE ON PLAN, GET ELEVATIONS)? YES - creeks + Ponds
8. ARE THERE ANY ROCK OUTCROPS? NO (DESIGNATE ON SITE PLAN, BRING SAMPLE TO LAB)
9. ARE THERE COBBLES AND/OR BOULDERS AT SURFACE (DESIGNATE AREAS ON SITE PLAN)? NO

DESCRIBE ANY EXISTING BUILDINGS, BASEMENTS OR EXCAVATIONS ON SITE OR ADJACENT TO IT, EXCLUDING TYPE OF FOUNDATION AND LOADING, IF AVAILABLE.

Plant Buildings

1. ARE EXISTING BUILDINGS IN NEIGHBORHOOD DAMAGED FROM FOUNDATION MOVEMENT? IF YES, GIVE ADDRESS AND/OR LOCATION. NO
2. WOULD HOLES STAND OPEN FOR DRILLED PIERS? NO APPROXIMATELY HOW DEEP? _____ FOR BELLED PIERS? YES AT WHAT DEPTH IN Bedrock
3. WERE HOLES LEFT OPEN? YES WHY? W/T
4. WOULD YOU RECOMMEND TAKING ADDITIONAL WATER-TABLE MEASUREMENTS? YES
5. DATE DRILLING WAS COMPLETED 10-30-75
6. WERE LOCAL ENGINEER AND ARCHITECTS CONTACTED? (IF OUT OF TOWN) —
7. ANY OTHER COMMENTS, SUGGESTIONS OR CAUTIONS —

R. 1

WATER TABLE

DATE: 10-31-75

HOLE NUMBER	HOLE DEPTH*	DEPTH TO WATER**	DEPTH TO MUD**	DEPTH TO** DRY BOTTOM	REMARKS
7	45.0	6.6			
8	45.0	12.6			
9	30.0	6.6			
10	20.0	6.0			
11	15.0			14.0	
17	50.0	17.0			
34	20.0			17.0	CAVED
35	20.0			18.6	CAVED
36	20.0			15.6	CAVED
37	20.0			16.6	CAVED
38	25.0			18.6	CAVED
39	30.0	21.6			
40	25.0		24.6		
41	25.0		24.6		
42	20.0	7.0			
43	20.0	6.6			
44	30.0	7.0			
45	25.0	10.0			
46	25.0	12.6			
47	20.0	13.0			
48	20.0	8.0			
49	20.0	5.0			
50	35.0	5.6			
51	20.0	7.6			
52	27.0	4.6			
53	33.0	11.6			
54	50.0	32.0			

JOB NO. 14767

CHECKED BY: RICH + JOE

* FROM FIELD ENGINEER'S DRILL LOGS

** GROUND SURFACE TO WATER/MUD/DRY BOTTOM

NOTE: IF HOLE IS CAVED, INDICATE IN REMARKS

WATER TABLE

DATE: 10-30-75

HOLE NUMBER	HOLE DEPTH*	DEPTH TO WATER**	DEPTH TO MUD**	DEPTH TO** DRY BOTTOM	REMARKS
5	35.0	10.0			
6	50.0	14.0			
12	30.0	25.6			
13	40.0		11.0		CAVED
14	50.0	14.0			
15	60.0	16.0			
16	60.0	8.0			
18	35.0	14.0			
19	30.0	12.0			
20	40.0	18.0			
21	25.0	9.0			
22	20.0	10.0			
23	15.0	10.6			
24	10.0			9.0	
25	10.0			9.0	
26	10.0			9.6	
27	15.0	11.0			
28	15.0			12.6	CAVED
29	10.0			8.0	CAVED
30	10.0			8.0	CAVED
31	10.0			8.0	CAVED
32	15.0			14.0	
33	15.0			10.0	CAVED

JOB NO. 14947CHECKED BY: RICH + JSP

* FROM FIELD ENGINEERS DRILL LOGS

* GROUND SURFACE TO WATER/MUD/DRY BOTTOM

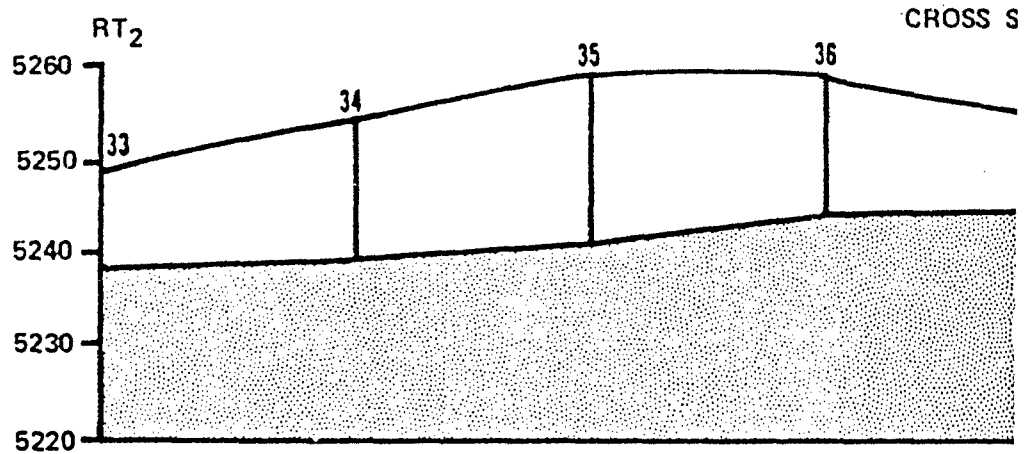
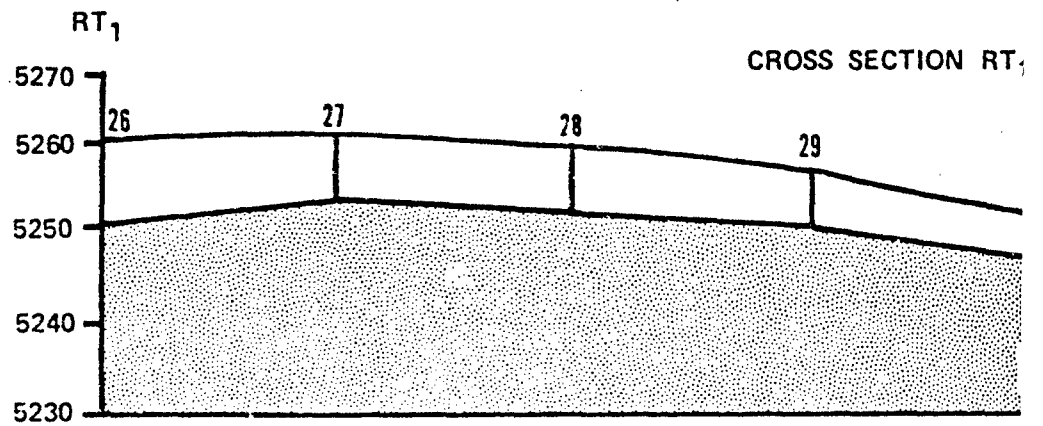
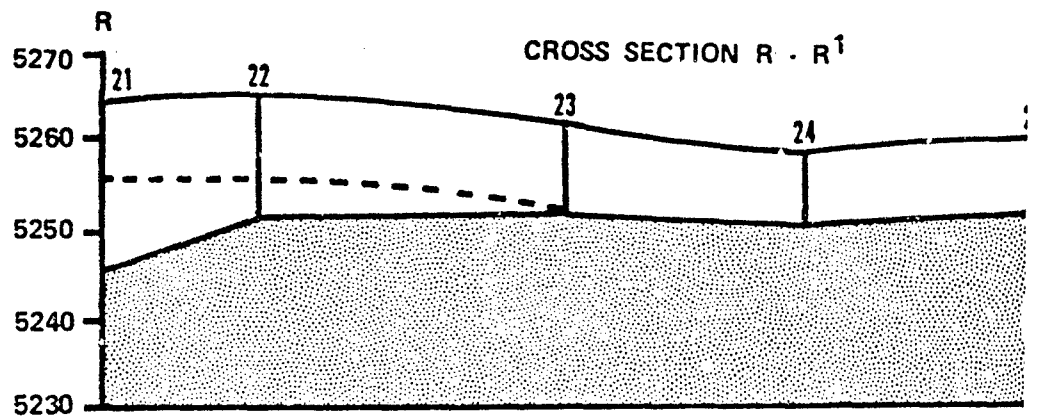
NOTE: IF HOLE IS CAVED, INDICATE IN REMARKS

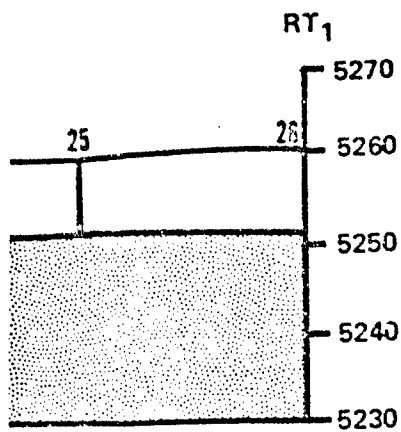
WATER TABLE

DATE: 12-27-75

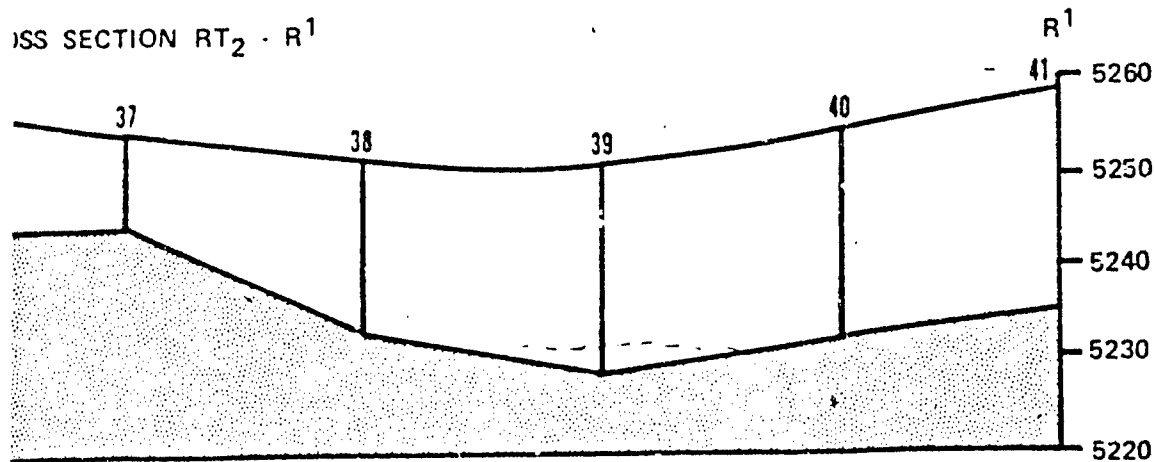
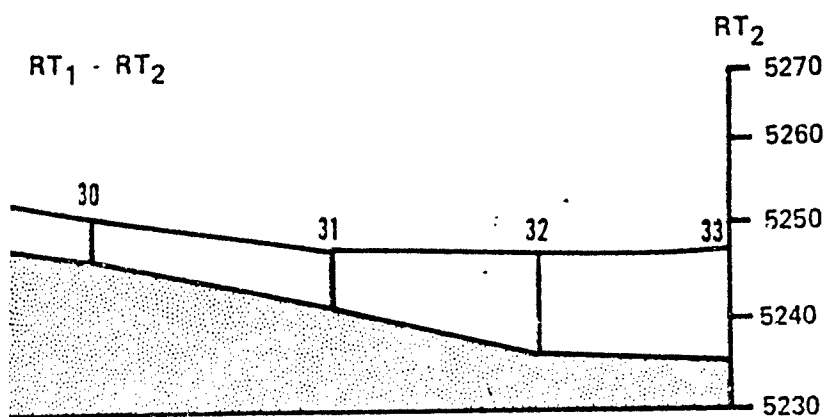
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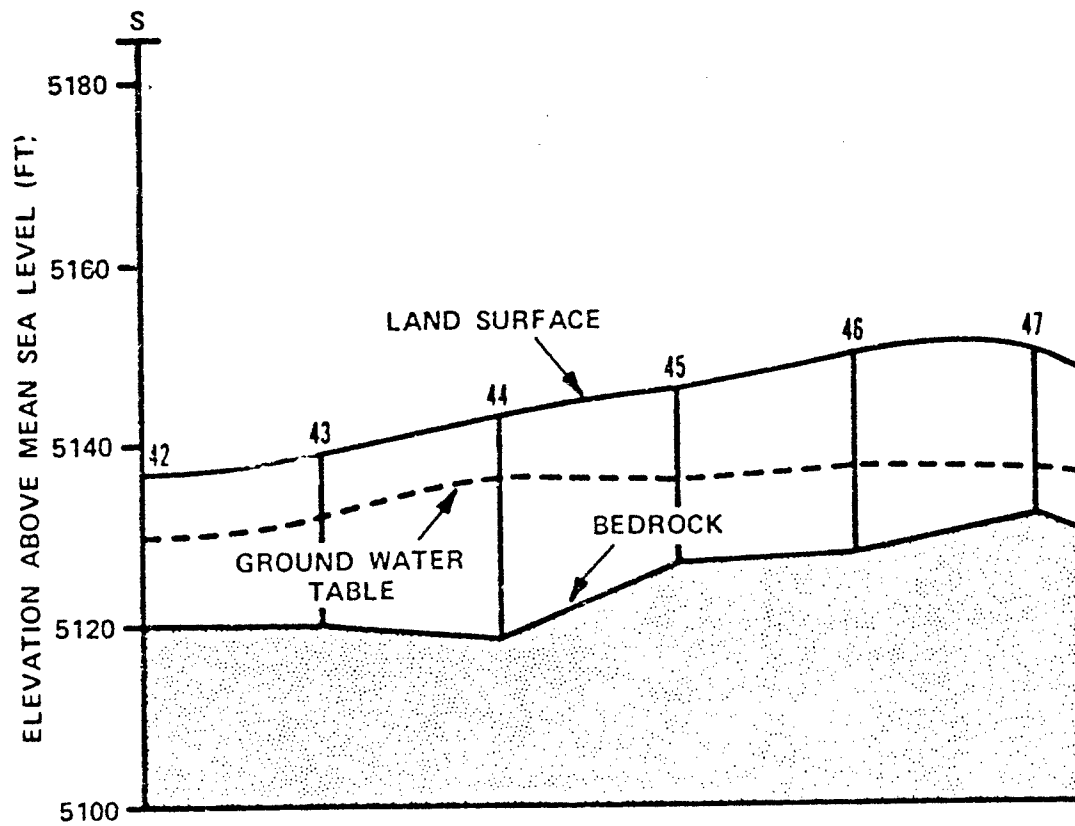
DB NO. 14747 CHECKED BY: RICH L JOE
FROM FIELD ENGINEERS DRILL LOGS
GROUND SURFACE TO WATER/MUD/DRY BOTTOM
NOTE: IF HOLE IS CAVED, INDICATE IN REMARKS



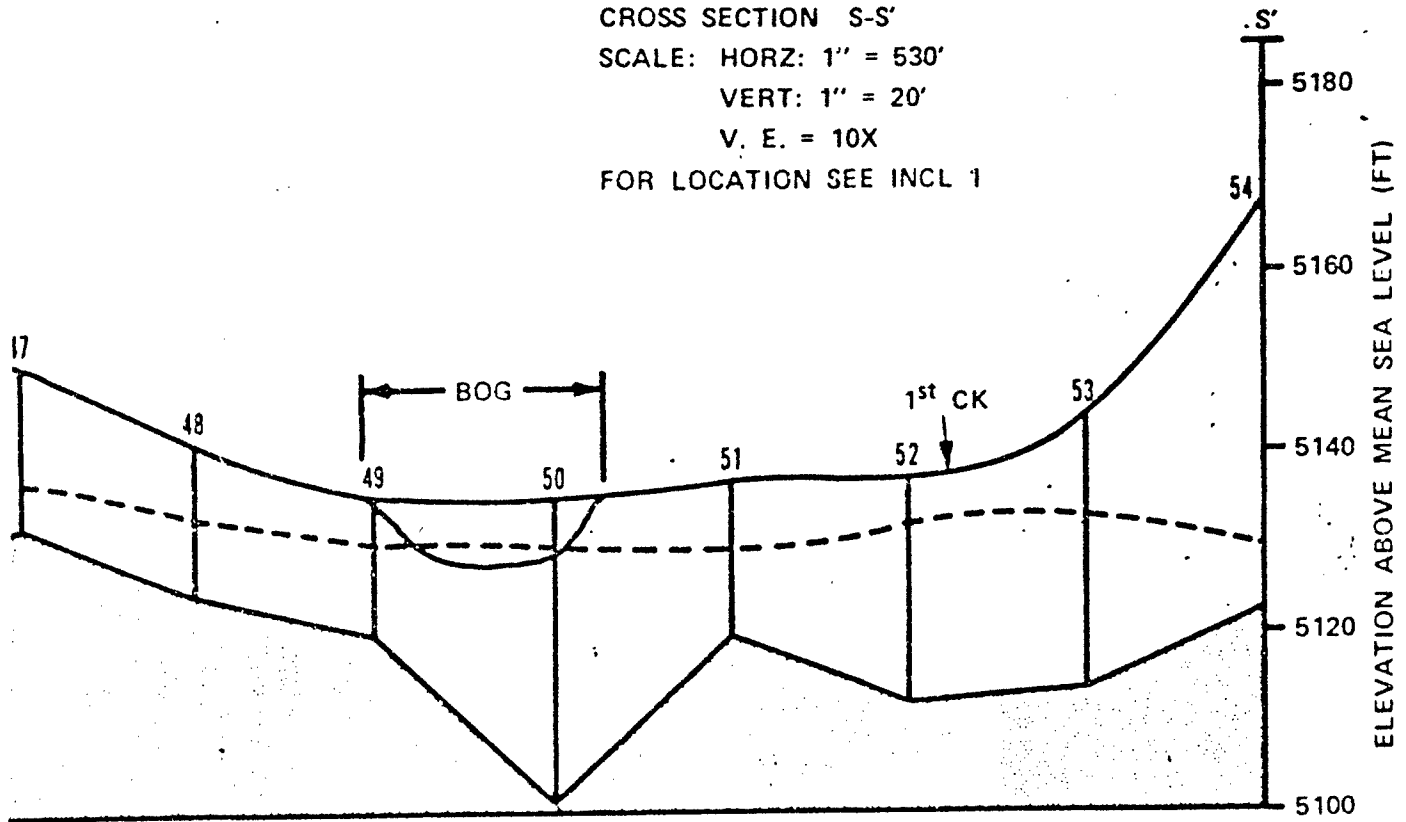


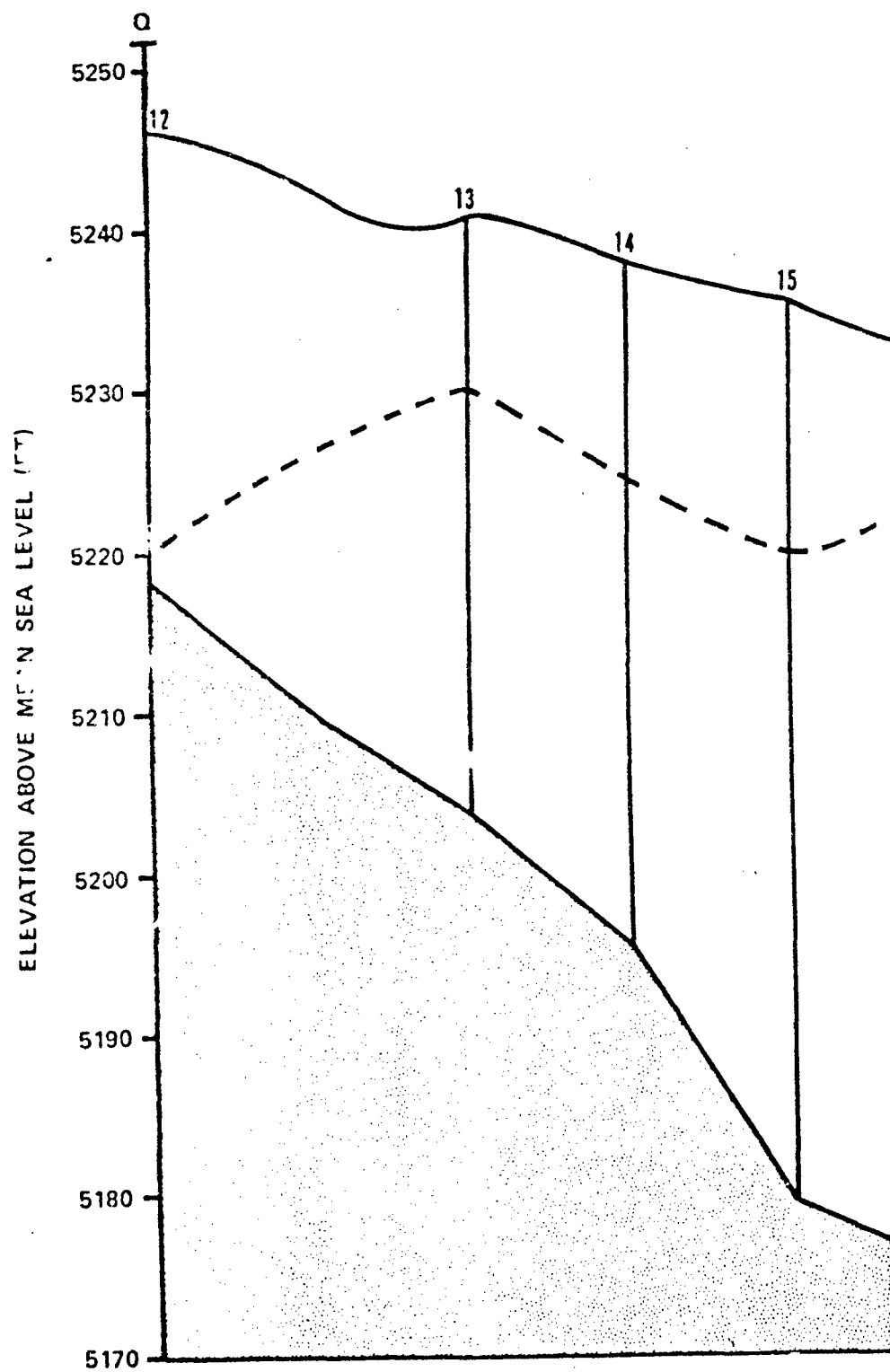
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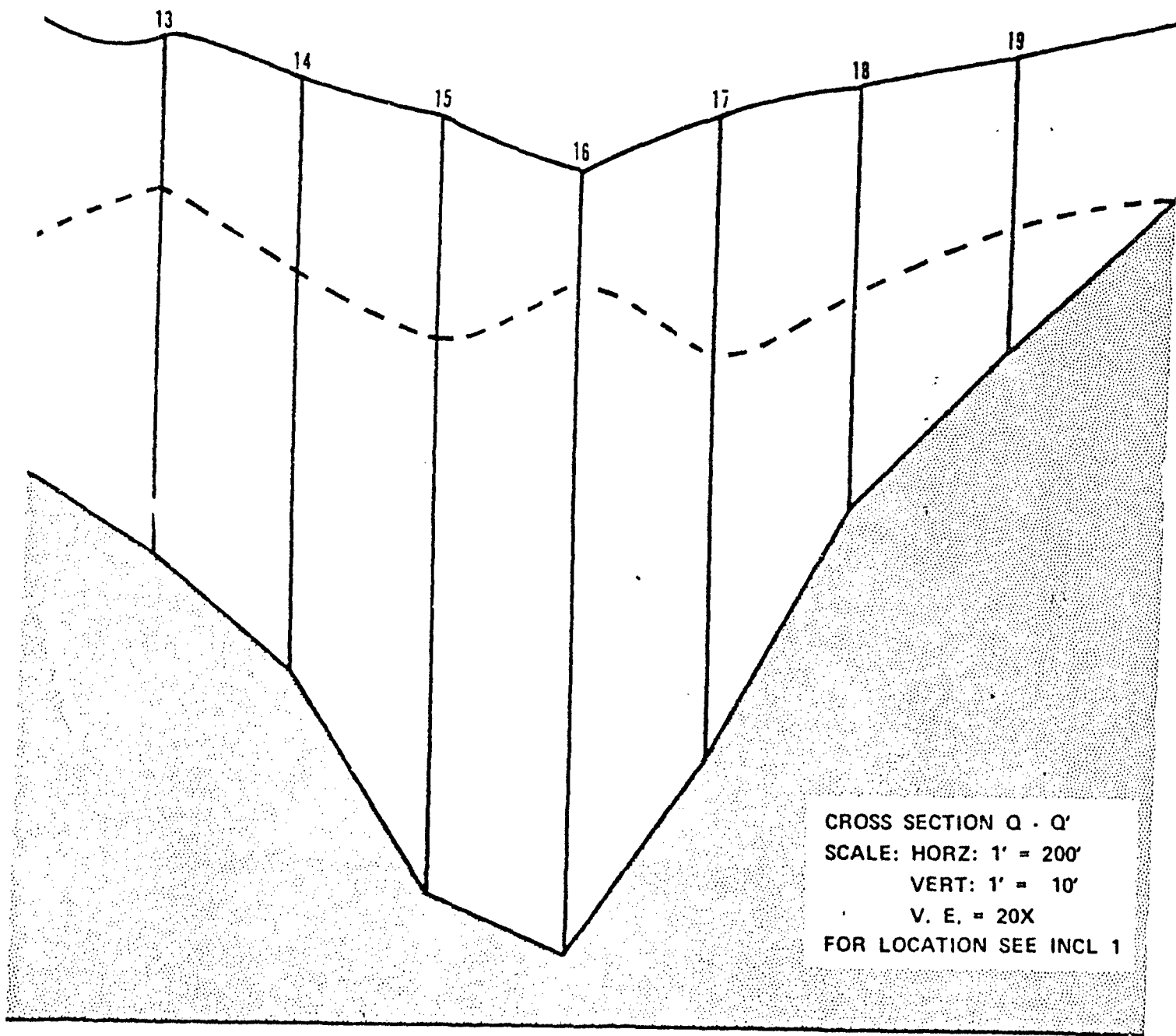


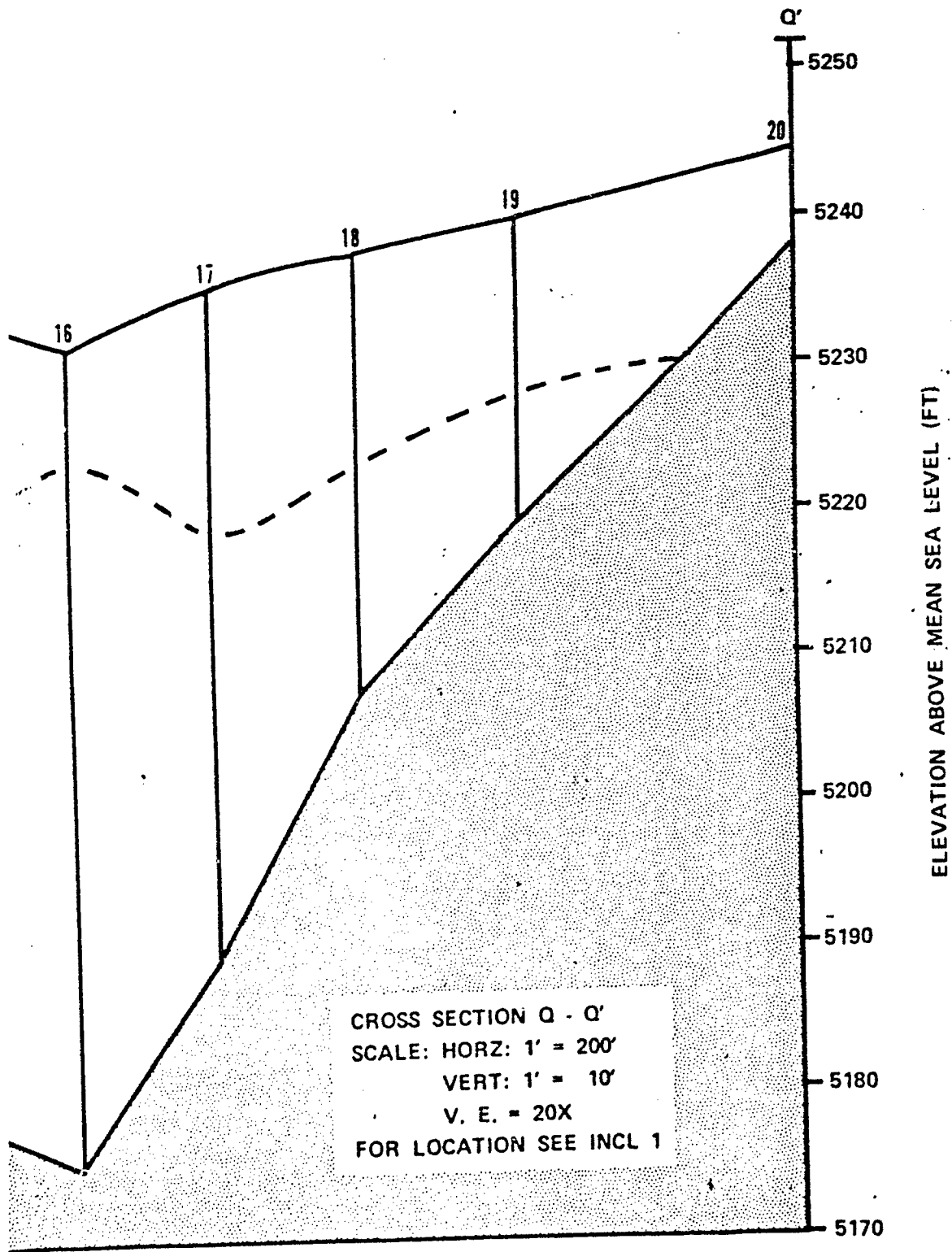


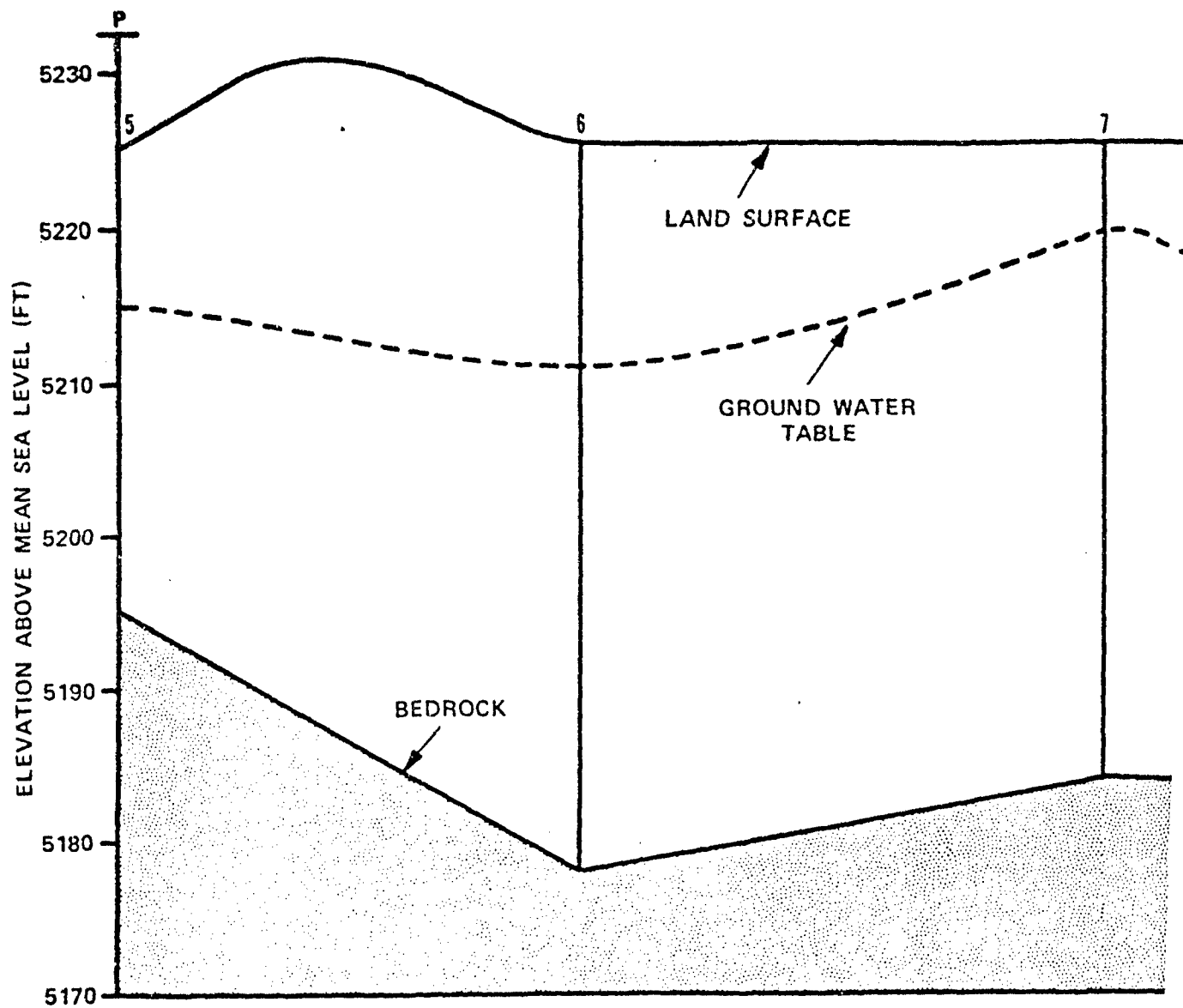
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V. E. = 10X
FOR LOCATION SEE INCL 1

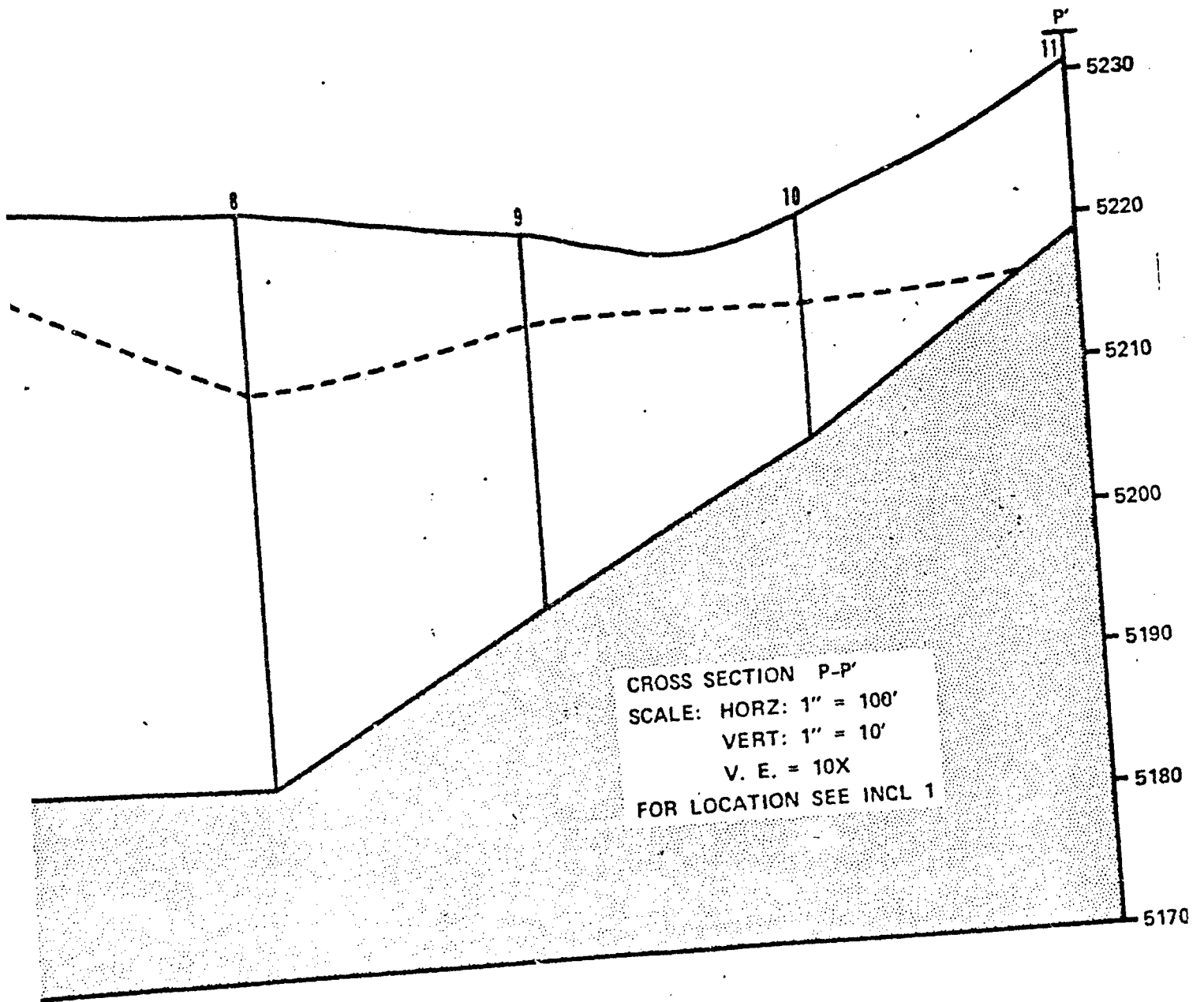


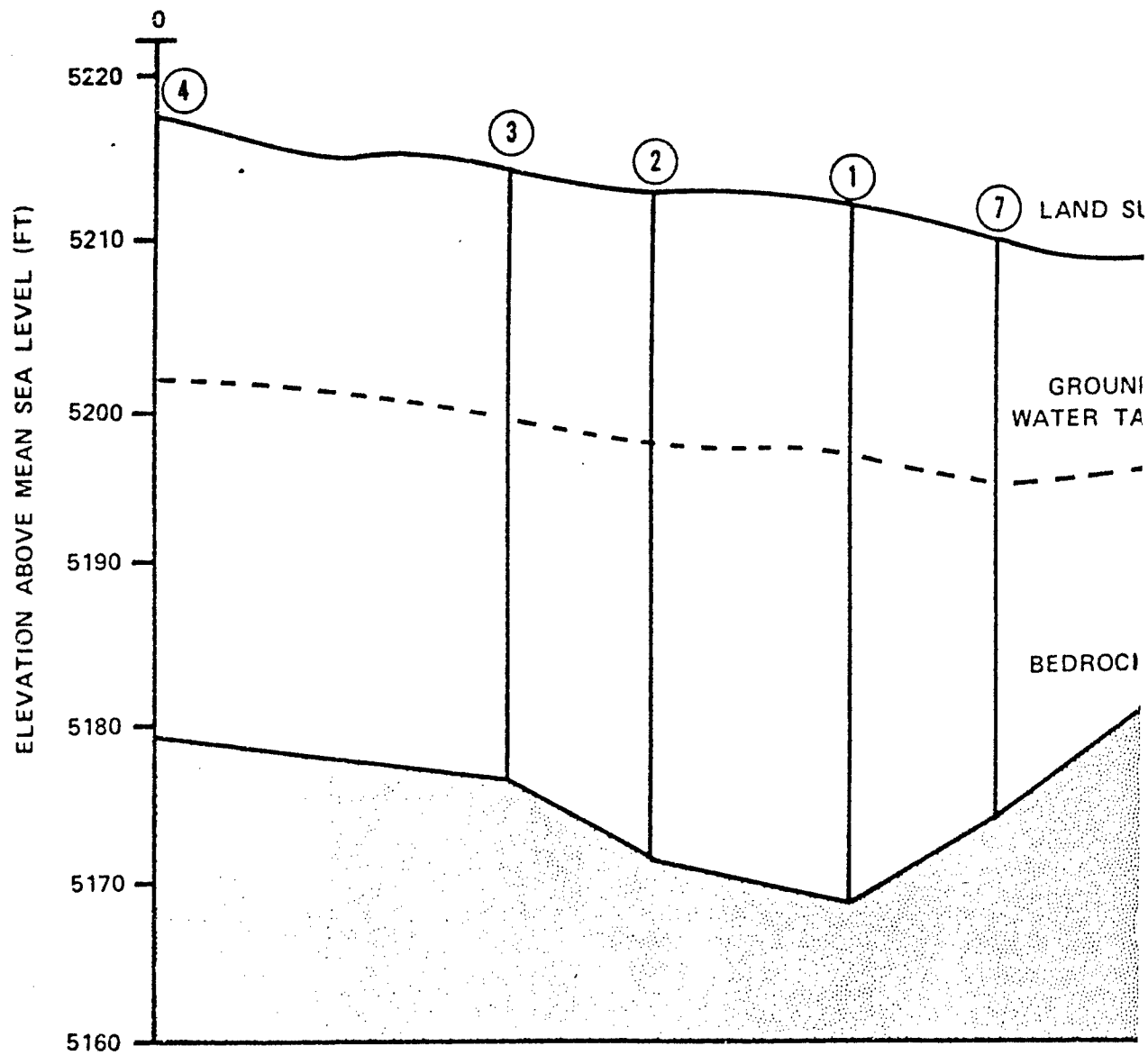




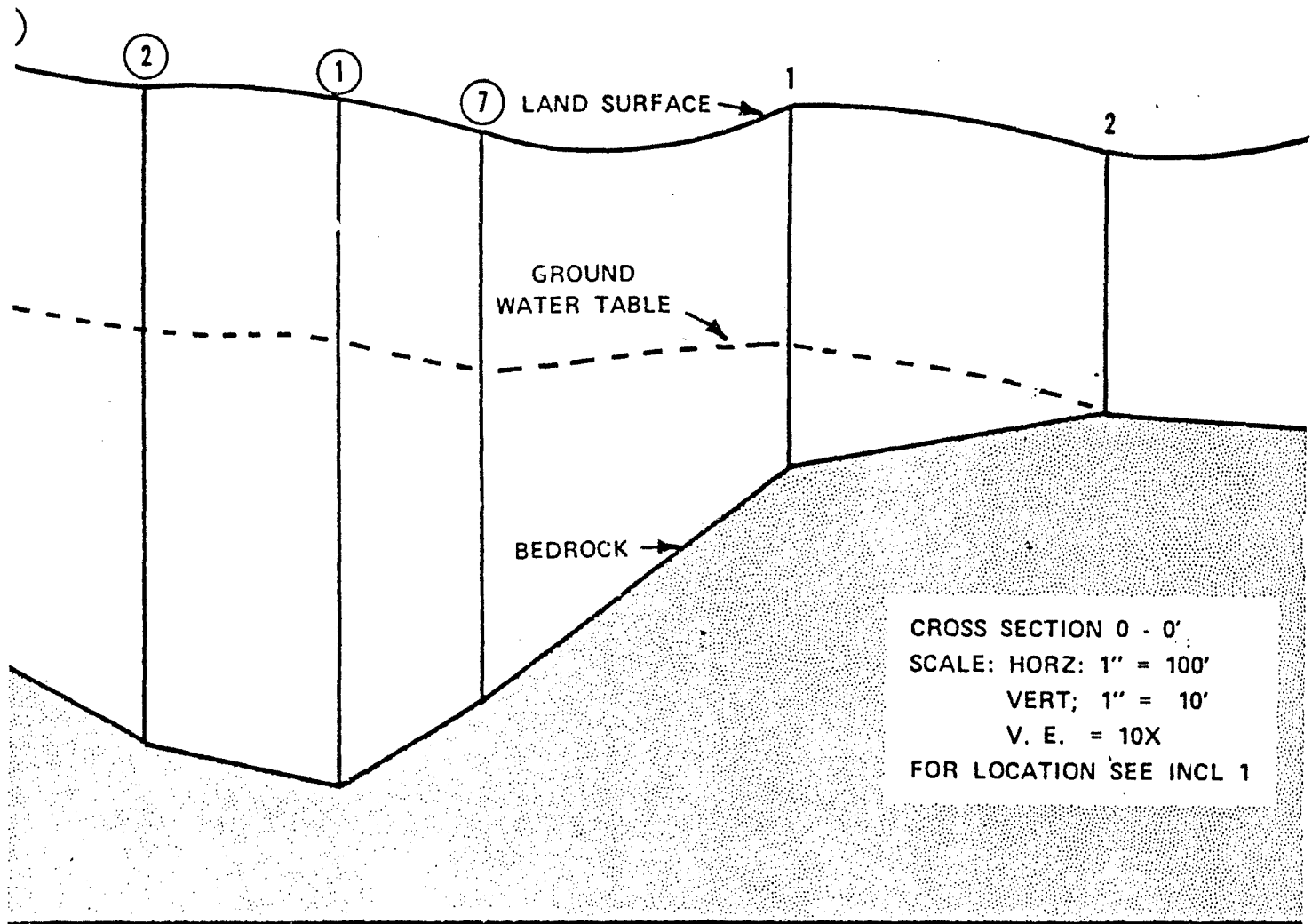


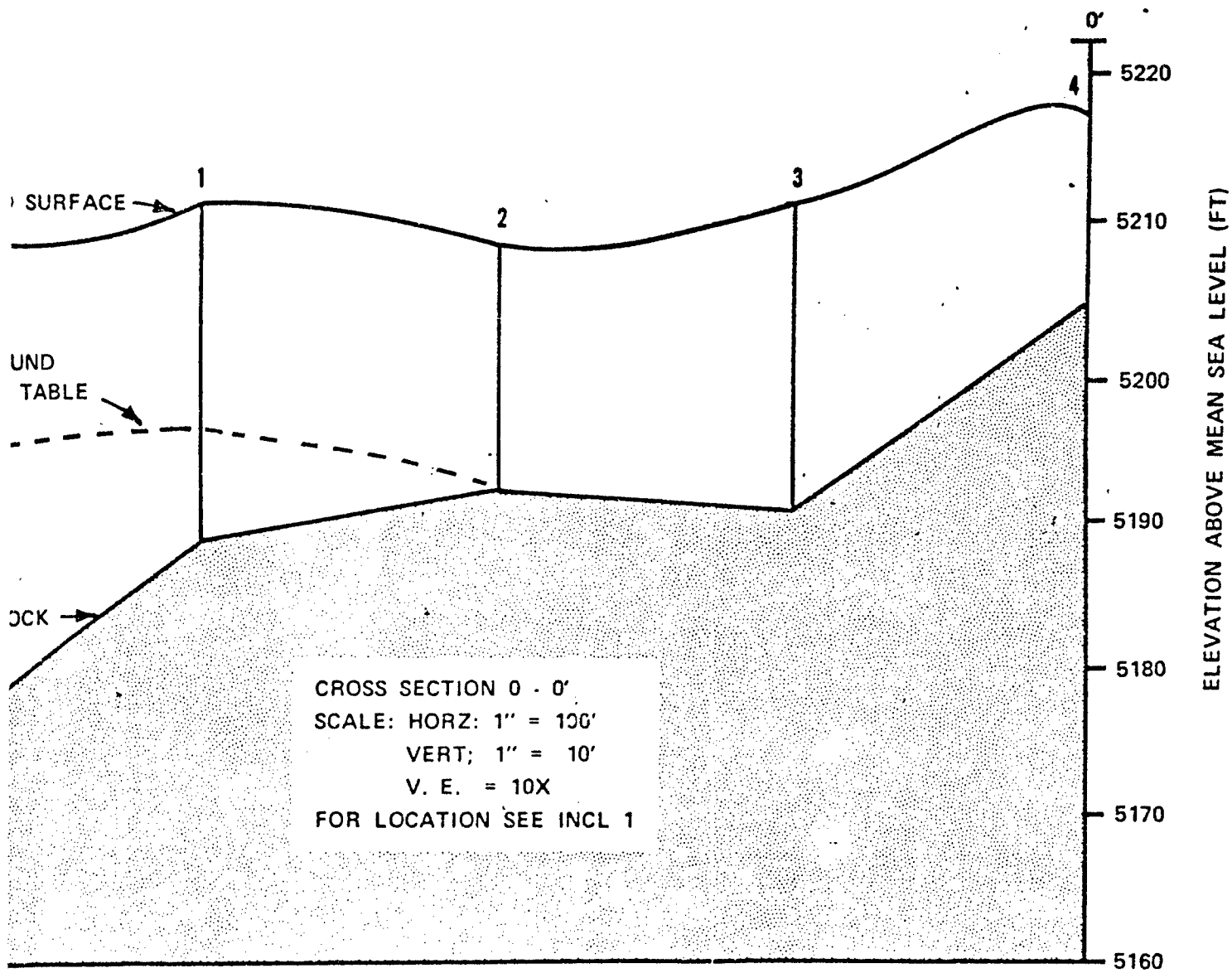


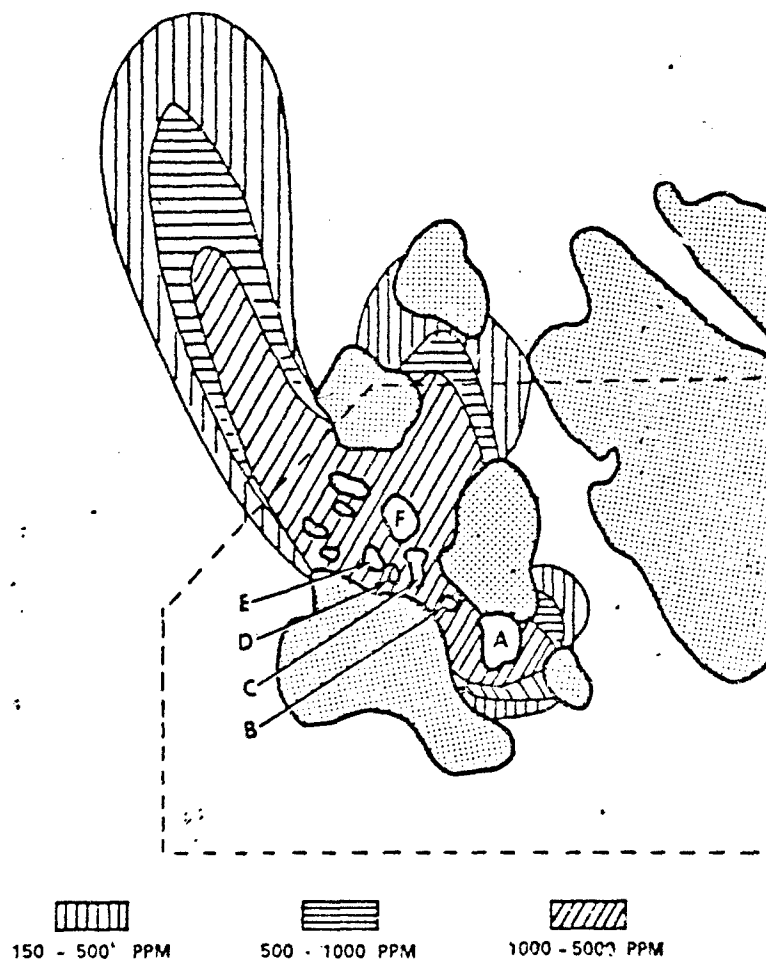




Incl 3







OBSERVED AREA OF CHLORIDE CONTAMINATION IN 1956
(AFTER KONIKOW, 1975)

Incl 4